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20th century U.S. mineral prices decline in constant dollars

by

Daniel E. Sullivan, John L. Sznopek, and Lorie A. Wagner

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20th Century U.S. Mineral Prices Decline in Constant Dollars

Abstract

      Price indexes developed by the U.S. Geological Survey (USGS) indicate that the long-term constant dollar price of key U.S. mineral raw materials declined over the last century, even though the need for mineral raw materials increased during the same period. Technologies and reduced production costs have allowed mineral production to remain profitable, while lower priced mineral products from domestic and foreign sources helped fuel growth in other sectors of the economy.

Introduction

      Economic theory states that the price of commodities reflects the relationship between supply and demand. Price influences the amount of material available in the market and illustrates the long-term ability of the economy to meet the demand for materials

      To better understand the long-term trends in mineral commodity prices, the USGS has developed price indexes for selected mineral commodities in the United States. These indexes are based on the prices of mineral commodities over time using their relative 1997 quantity of production as a base[1]. To compare the price changes, the data were converted to constant dollars by using the U.S. Consumer Price Index (CPI), the most accepted measure of inflation in the United States. The general trend of prices over time is shown by trend lines drawn by using the least squares method.

What Are Constant Dollars?

Constant dollars are dollars in which the effects of changes in the purchasing power of the dollar over time have been removed. Constant dollars, therefore, have comparable purchasing power in different time periods and are on equivalent terms. If in year A, $1 purchased goods that cost $2 in the base year, the constant dollar value of the dollar in year A is $2. The Consumer Price Index (CPI), an index that approximates the changes in average prices, is used to estimate constant dollars.

Price Indexes

      The U.S. mine production composite price index (fig. 1) is computed by USGS analysts by using data for five metal commodities (copper, gold, iron ore, lead, zinc) and seven industrial mineral commodities (cement, clay, crushed stone, lime, phosphate rock, salt, sand and gravel). During 1997, these commodities accounted for 89 percent of the value of metal mine production and 86 percent of the value of industrial mineral mine production in the United States. Aluminum, which is consumed in large quantities in the United States, is not included in this index because production of bauxite, the ore from

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[1]This analysis is part of a larger study on the economic drivers of mineral supply. The indexes are based on the Laspeyres price index methodology. The data for these indexes can be found in *Minerals Yearbooks* of the USGS and the former U.S. Bureau of Mines. A database of U.S. material consumption, including historical prices, is in preparation.

which aluminum is derived, is not significant in the United States. However, a discussion of aluminum prices is included because of its economic significance.

Overall, the trend of inflation-adjusted prices shown in the composite index declined throughout the 20th century. The use of mineral materials in the United States increased during this timeframe to meet the needs of the economy. The declining long-term price trend is the result of adequate sources of supply, competition, and reduction in the costs of production.
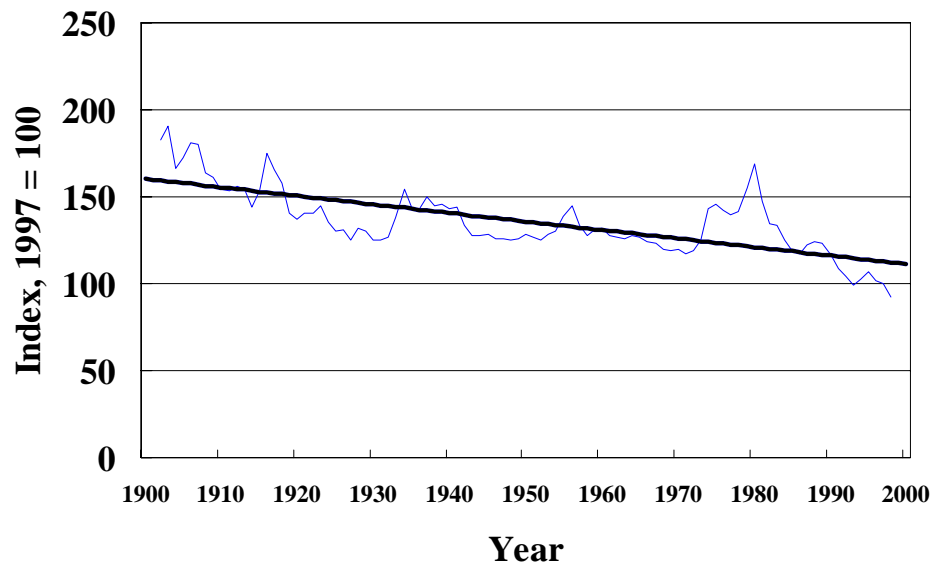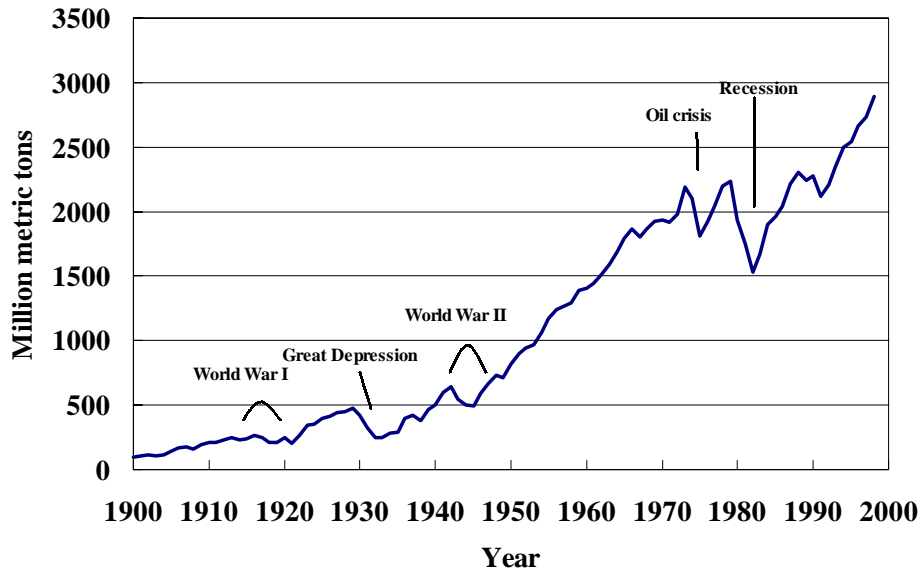

Figure 1. Composite price index, in constant 1997 dollars.

The Flow of U.S. Mineral Commodities

During the 20th century, the quantity of minerals flowing through the U.S. economy (as measured by apparent consumption) increased from 93 million metric tons in 1900 to 2,900 million metric tons in 1998. Peaks and troughs reflect major economic events including World War I, the Great Depression, World War II, the 1970's energy crisis, and the recession of the 1980's. More information on the flow of mineral commodities in the U.S. economy is available in Matos and Wagner, 1998.

Both industrial and metal mineral commodity prices declined during the 20th century (fig.2). Industrial minerals account for two-thirds of the total value of mineral production included in the U.S. economy. Some industrial minerals are crucial to the U.S. construction industry.
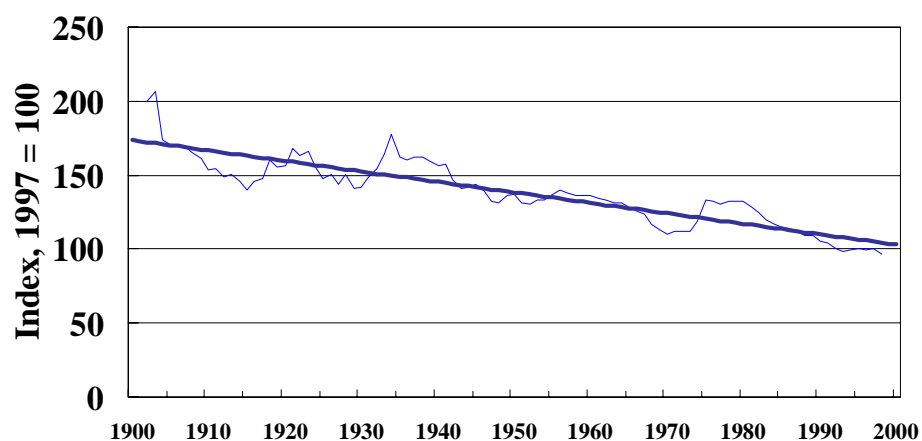
Figure 2. Industrial minerals price index, in constant 1997 dollars.

All seven industrial mineral commodities included in the price index have a declining constant-dollar-price trend in the 20th century. The price history of crushed stone is shown in figure 3. Crushed stone accounts for one-third of the value of production of industrial minerals included in that index and in 1997 was the industrial mineral having the largest value of mine production in the United States. Most crushed stone was used in the construction of buildings, highways, bridges, and other infrastructure.
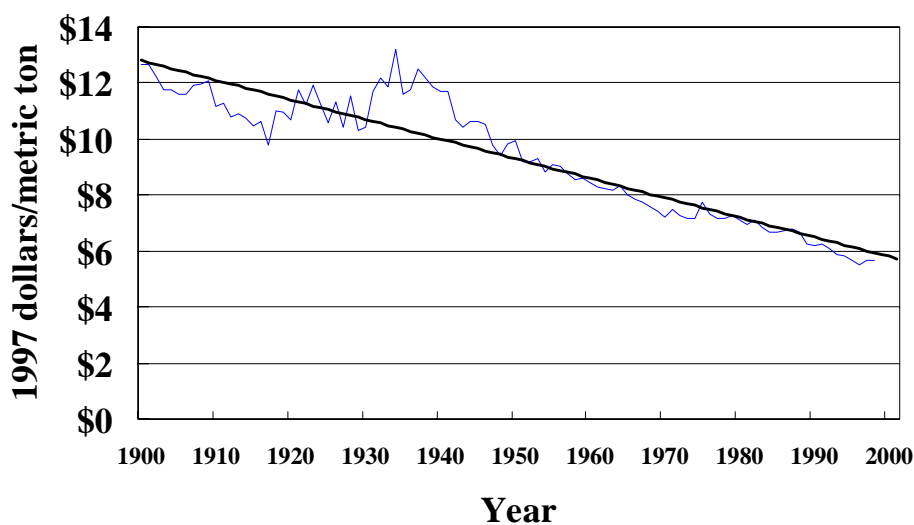

Figure 3. Crushed stone price, in constant 1997 dollars.

The metals price index shows more volatility than the industrial minerals price index throughout the century (fig. 4). Copper, lead, and zinc, which constitute 51 percent of the index, show downward trends. However, the trends for gold and iron ore prices,

which constitute the remainder of the index, were up slightly. When the metals are combined into the metal price index, it has a slight downward trend.
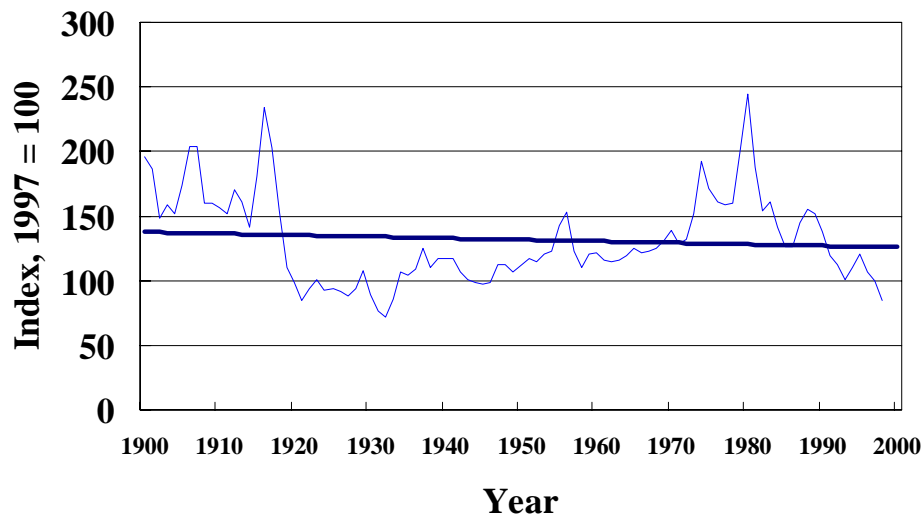
Figure 4. Metals price index, in constant 1997 dollars.

Copper was the metal having the largest value of mine production in the United States in 1997. It is an important material input in plumbing, transmission of electricity, and electronic applications. As with most of the other mineral commodities, its price is sensitive to economic cycles and political events, but the trend in constant dollar terms is declining (fig. 5). The price of copper experienced a significant rise during World War I, a drop during the Great Depression; steady prices during World War II (because of price controls) and an increase from the end of World War II through the late 1970's.
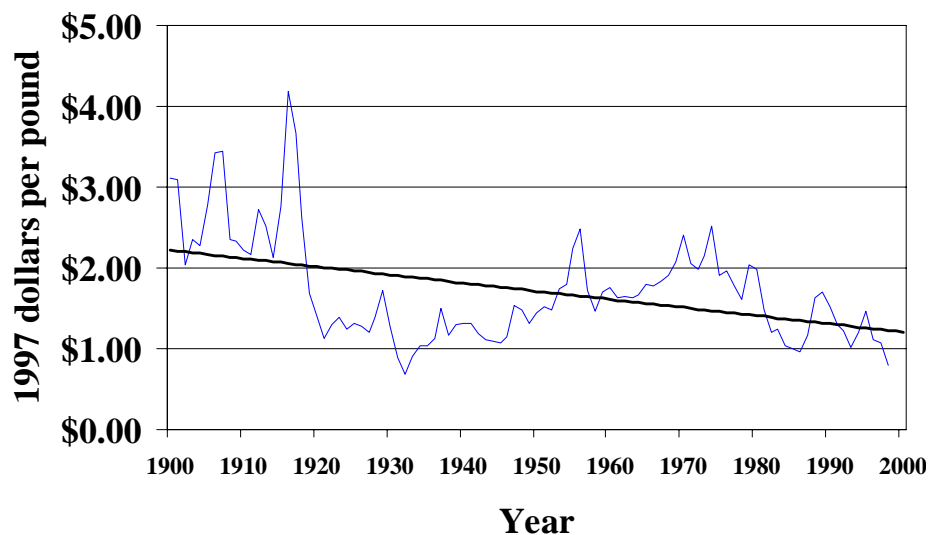
Figure 5. Copper price, in constant 1997 dollars.

Gold is unlike other commodities. Individuals use it as an insurance against inflation and adversity. Monetary systems have used gold as a standard of value for centuries. The United States Government fixed the price of gold at $20.67 per troy ounce from 1837 to 1934 and at $35 from 1934 to 1968. Since 1968, the United States has been off the gold standard, and the market has set the price of gold. With the second largest value of mine production in 1997, gold shows an increasing trend in constant dollars. But the upward trend in 1997 dollars could be viewed as misleading because the price was fixed by the United States prior to 1968. Note that the prices of gold shown in figure 6 are adjusted to 1997 constant dollars and, therefore, do not match the fixed (current dollar) prices previously mentioned. Since 1980, when gold was used as a hedge against inflation, the trend of the price of gold, in both current and constant dollars, is downward.
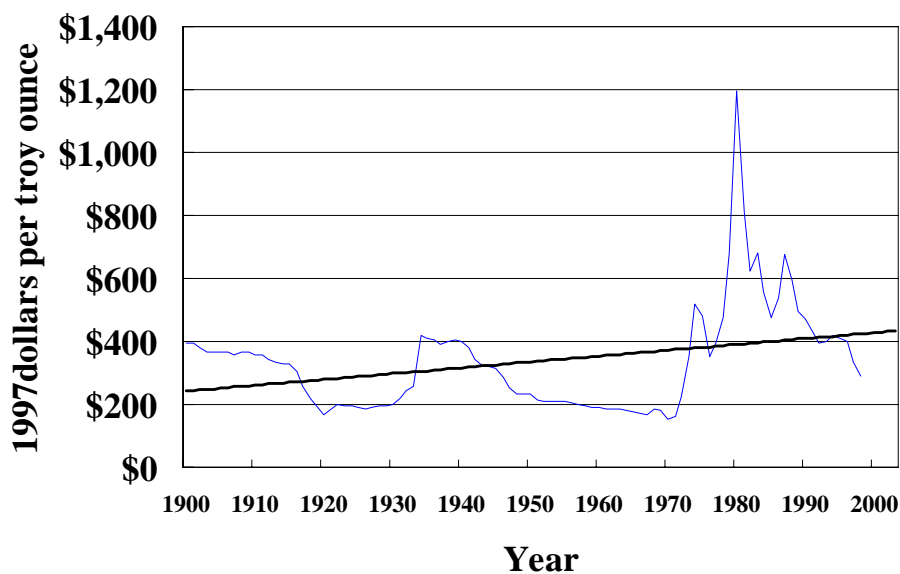

Figure 6. Gold price, in constant 1997 dollars.

Aluminum (usually made from the ore bauxite) is not included in the metal price index of domestic mine production because domestic production of bauxite is less than 1 percent of the U.S. requirement and because domestic bauxite is not used to produce metal, but abrasives, chemicals, and refractories. The trend of aluminum prices is shown in figure 7. Before World War I, the price was high because the production process was in its infancy and supply was limited. The price of aluminum peaked during World War I and since then has declined similarly to other mineral commodities.
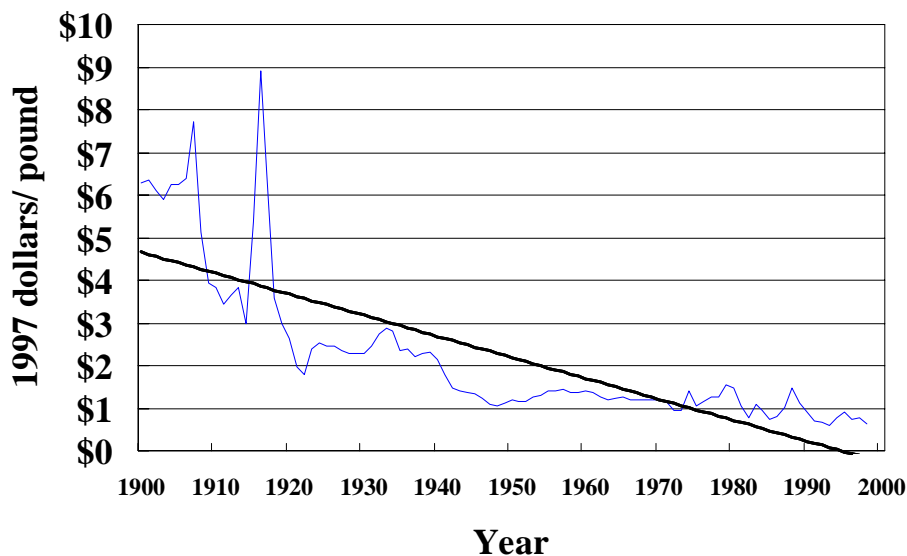
Figure 7. Aluminum price, in constant 1997 dollars.

The declining trend of constant dollar price indexes indicates that the supply of mineral raw materials has been more than sufficient to meet mineral requirements of the U.S. economy in the 20th century. The amount of mineral raw materials produced is dependent on many factors at every stage of the material lifecycle. Because of new technologies, copper and gold are being extracted from increasingly lower grade ores by using new mining and processing methods. As higher- grade ores were depleted in the 1950's, U.S. mining companies began recovering iron from taconite, a lower grade iron ore. While low production costs help keep prices low, low prices can stimulate new uses, generating new demands for minerals. For example, reinforced concrete construction has revolutionized the building industry over the last century increasing the demand for mineral construction materials. Product designs have also changed in response to materials availability. The design of thin walls for metal beverage containers results in using less material, thus increasing the supply available for other products and helping to hold down metal prices. Products are continually redesigned, such as the use of plastic instead of metal in plumbing and automobiles, to meet cost or performance criteria. The reuse and recycling of mineral materials also contribute to the declining trend in constant dollar prices. For example, recycling accounts for 38 percent of the aluminum supply, 55 percent of steel, and 63 percent of lead. The ever-increasing globalization of mineral production increases competition, which spurs cost reduction strategies, helping to keep prices low.

For additional information, contact Daniel Sullivan at 303-236-8747 x267, or desulliv@usgs.gov .

Minerals information can be found at the following USGS web site: http://minerals.usgs.gov/minerals.

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Further Reading

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